High enhancement of Eu^{3+} luminescence in $SrAl_4O_7$ phosphor by means of charge compensation with Na^+ ions.

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Streszczenie

A comparative study of the luminescent properties of SrAl4O7:Eu3þ(x%) and SrAl4O7:Eu3þ(x%),Naþ(x%) (x¼0.002e0.1) phosphor powders as a function of activator concentration is reported. Upon UV exci-tation both series of compounds exhibit strong characteristic red Eu3þphotoluminescence with amaximum around 611.5 nm, which intensity increases with an increase of activator content. It was foundthat the luminescence spectra of singly Eu3þdoped strontium aluminate are much more concentrationdependent. As the dopant content increases, the spectra of SrAl4O7:Eu3þshow an increased linebroadening and the emergence of new emission components. The observed changes in the studiedconcentration range are due to an increased disorder of Eu3þlocal symmetry induced by the increase inthe number of defects in host lattice and by the presence of a new crystalline phase that occurs at thehigher dopant content. Charge compensation through Naþco-doping facilitates an incorporation of Eu3þinto the SrAl4O7lattice and leads to a smaller symmetry disorder of activator surroundings as well as asignificantly enhanced Eu3þluminescence intensity. The largest increase in emission intensity (~6.5times) was observed for 7%-doped sample. Concentration dependences of the luminescence kinetics ofboth types of materials are clearly different. It was found that for singly Eu3þdoped SrAl4O7the5D0lifetime shortens with the increase of activator content from 1.8 to 1.4 ms while for Naþco-doped SrAl4O7this value does not vary over a range of concentrations and is approximately 1.8 ms. SrAl4O7:Eu3þ,Naþpowders are potential candidates to be used as luminescent materials.

Słowa kluczowe

SrAl 4 O 7, Eu 3 þ -doped, charge compensation, luminescence, decay kinetics